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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/912,558	07/26/2001	Ronald A. Weimer	M4065.0319/P319-A	5990
24998	7590	07/20/2004	EXAMINER	
DICKSTEIN SHAPIRO MORIN & OSHINSKY LLP			KIELIN, ERIK J	
2101 L STREET NW			ART UNIT	
WASHINGTON, DC 20037-1526			PAPER NUMBER	
			2813	

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Please find below and/or attached an Office communication concerning this application or proceeding.

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Office Action Summary	Application No. 09/912,558	Applicant(s) WEIMER ET AL.	
	Examiner Erik Kielin	Art Unit 2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 02 June 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 13,14,16,17 and 42 is/are pending in the application.
4a) Of the above claim(s) none is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 13,14,16,17 and 42 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

This action responds to the Amendment filed 2 June 2004.

Claim Rejections - 35 USC § 112

1. Claim 42 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

The instant specification fails to provide support for using only “hydrogen and oxygen gases.” In this regard, the specification states at p. 8, lines 18-25,

“If a mixture of H₂ and O₂ gases is used to form the steam, suitable ratios of H₂ gas to O₂ gas are in the range of about 0.1 to about 0.80... The ratio of steam relative to **other gases** in the chamber 50 **should be at least as high as 0.005, and preferably is in the range of about 0.1 to about 0.5**, although lesser or greater amounts also can be used.”
(Emphasis added.)

Accordingly, there exists no support for using **only** hydrogen and oxygen since the specification indicates that “other gases” should be present, thereby teaching away from “**only** hydrogen and oxygen.”

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for

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patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 13, 14, 17, and 42 are rejected under 35 U.S.C. 102(e) as being anticipated by US 6,114,258 (**Miner** et al.).

Regarding independent claims 13 and 42, **Miner** discloses a method of forming a gate dielectric layer on a substrate comprising the steps of

depositing a dielectric film 105 over an active region of a semiconductor substrate 100 to from part of a gate of a transistor (col. 2, lines 20-22), wherein the dielectric film is, *inter alia*, silicon nitride (col. 4, lines 31-36; Figs. 1-3) --as further limited in claim 17; and

subjecting the dielectric film to a wet oxidation with steam process to raise the oxygen content of said dielectric film, provided by heating a mixture of hydrogen and oxygen gases in a rapid thermal process chamber at a temperature greater than 450 °C, particularly 400 °C to 1200 °C (col. 8, lines 13-32) and specific examples of 600 °C (col. 9, line 35) and 950 °C (col. 8, lines 44-56) for a period of 30 to 120 seconds (Figs. 8a-8b; col. 10, lines 3-4)--as further limited by instant claim 14-- wherein said dielectric film undergoes wet oxidation with only a mixture of hydrogen and oxygen gases that form steam. The H₂ to O₂ ratio is 0.5/1 or less, for oxygen-rich mixtures (col. 8, lines 61-62), which falls within the claimed H₂ to O₂ ratio of 0.1 to 0.8. The ratio of "said mixture" (i.e. steam) relative to the other gases in the chamber overlaps the range of 0.1 to 0.5 and is therefore anticipated (col. 8, line 57 to col. 9, line 23).

Further regarding claim 42, the pressure is potentially about atmospheric pressure at least during a detonation of the hydrogen and oxygen gases (col. 8, line 44 to line 56).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 13, 14, 16, and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over the article **Luan**, et al. "Ultra thin high quality Ta₂O₅ gate dielectric prepared by in-situ rapid thermal processing" Electron Devices Meeting, held 6-9 December 1998, IEDM '98 Technical Digest, pp. 609-612 in view of US 6,063,698 (**Tseng** et al.).

Regarding independent claims 13, **Luan** discloses a method of forming a gate dielectric layer on a substrate comprising the steps of:

depositing a dielectric film over an active region of a semiconductor substrate to form part of a gate of a transistor, wherein the dielectric film is tantalum oxide (Ta₂O₅), as further limited in claim 17, having the inherent property of a dielectric constant of "at least about 25" (Introduction), as further limited in instant claim 16; and

subjecting the dielectric film to a wet oxidation with a steam process to "improve film quality and reduce leakage current" by heating a mixture of hydrogen and oxygen gases using rapid thermal processing (RTP) and therefore occurring, by definition, in a RTP chamber, at a temperature of 600 °C for a period of about 40-50 seconds (Fig. 1), wherein said dielectric film undergoes wet oxidation with only a mixture of hydrogen and oxygen gases that form steam. (See whole **Luan** article which is very brief.)

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It is seen to be inherent that the oxygen content of the dielectric layer is increased because the film quality is improved and the leakage current reduced, as admitted in the instant specification to be known in the art and to be inherently provided by a wet oxidation process (instant specification, Abstract; p. 1, lines 28-32; p. 3, lines 13-20, p. 4, lines 9-13, etcetera). Since Luan teaches the leakage current is reduced by performing a wet oxidation using hydrogen and oxygen, it is seen to be inherent based upon Applicant's admissions of record, that the oxygen content of the dielectric layer is increased. (See MPEP 2112.)

Luan does not teach a wet oxidation temperature in the range of 750-950 °C or a ratio of H₂ to O₂ of about 0.1 to 0.8 (i.e. 10% to 80% H₂).

Tseng teaches a process virtually identical to **Luan** of forming a tantalum oxide gate dielectric **14** on a semiconductor substrate **12** and then subjecting the tantalum gate dielectric "with only a mixture of hydrogen and oxygen gases that form steam" by heating a mixture of H₂ and O₂ to a temperatures of 750-850 °C, wherein the H₂ to O₂ ratio is about 0.03 to about 0.09, which is about 0.1, (col. 6, lines 58-63) to beneficially "eradicate trap sites **16** and **18**" (col. 6, lines 39-57).

It would have been obvious to one of ordinary skill at the time of the invention to modify the method of **Luan** to use the temperature and ratio of hydrogen to oxygen taught by **Tseng** in order to beneficially reduce the trap sites and improve the dielectric as taught by **Tseng** and to further reduce the leakage current as taught by **Luan** which is a direct measure of the reduction of trap sites, as taught by **Tseng** (Abstract; col. 4, first paragraph)--especially since the methods are virtually the same.

Further in this regard, it would be a matter of routine optimization to determine the optimum ratio of hydrogen to oxygen, since **Luan** clearly teaches the use of hydrogen and oxygen therefore expressly indicating some ratio. It has been held that claimed ranges of a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art. *In re Huang*, 40 USPQ2d 1685, 1688(Fed. Cir. 1996). In the instant case, there exists no evidence of record that the claimed ratio provides unexpected results relative to that used in **Luan** alone or **Luan** in view of **Tseng** --especially since **Luan** only fails to indicate what the ratio of hydrogen to oxygen is, such that one of ordinary skill would be motivated to optimize the ratio to get the best results. Furthermore, the temperature would also amount to routine optimization with consideration to **Tseng** because, it has been held that claimed ranges of a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art. *In re Huang*, 40 USPQ2d 1685, 1688(Fed. Cir. 1996). In this regard, the specification indicates and Applicant claims that 450 °C or greater will work. Accordingly, evidence of unexpected results for the temperature range of 750 to 950 °C is required.

Response to Arguments

6. Applicant's arguments filed 2 June 2004 have been fully considered but they are not persuasive.

Applicant argues that Miner does not teach “only a mixture of hydrogen and oxygen and gases that from steam.” Examiner respectfully disagrees for reasons indicated in the rejection of the claims above, which is incorporated herein in its entirety. (See Miner col. 8, line 57 to col. 10, line 56 for examples.)

Applicant argues that because Luan and Tseng teach **exemplary** different temperatures, that the references teach away. Examiner respectfully disagrees based upon precedent established by case law. Note, exemplary embodiments are not limiting nor a teaching away.

“The use of patents as references is not limited to what the patentees describe as their own inventions or to the problems with which they are concerned. They are part of the literature of the art, relevant for all they contain.” *In re Heck*, 699 F.2d 1331, 1332-33, 216 USPQ 1038, 1039 (Fed. Cir. 1983) (quoting *In re Lemelson*, 397 F.2d 1006, 1009, 158 USPQ 275, 277 (CCPA 1968)). A reference may be relied upon for all that it would have reasonably suggested to one having ordinary skill the art, including nonpreferred embodiments. *Merck & Co. v. Biocraft Laboratories*, 874 F.2d 804, 10 USPQ2d 1843 (Fed. Cir.), cert. denied, 493 U.S. 975 (1989). See also *Celeritas Technologies Ltd. v. Rockwell International Corp.*, 150 F.3d 1354, 1361, 47 USPQ2d 1516, 1522-23 (Fed. Cir. 1998) (The court held that the prior art anticipated the claims even though it taught away from the claimed invention. “The fact that a modem with a single carrier data signal is shown to be less than optimal does not vitiate the fact that it is disclosed.”). Disclosed examples and preferred embodiments do not constitute a teaching away from a broader disclosure or non-preferred embodiments. *In re Susi*, 440 F.2d 442, 169 USPQ 423 (CCPA 1971). “A known or obvious composition does not become patentable simply because it has been described as somewhat inferior to some other product for the same use.” *In re Gurley*, 27 F.3d 551, 554, 31 USPQ2d 1130, 1132 (Fed. Cir. 1994).

In this regard, Examiner respectfully submits that the case law of *In re Huang* is sufficient in and of itself to support the *prima facie* case of obviousness over the Luan reference --alone. Simply because Luan does not discuss a range of hydrogen to oxygen does not make the disclosure of such a range novel and non-obvious because there exists no evidence of unexpected results,

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according to precedent. The range of hydrogen to oxygen is obvious for reasons of record. One of ordinary skill would have to determine a range appropriate for the Luan method since Luan does not provide a range. Moreover, the instant specification very clearly shows there is (1) no criticality to the method by which the steam is produced since plural means are provided; (2) no criticality provided by the range of hydrogen to oxygen of 0.1 to 0.8; and (3) no evidence of unexpected results for using the claimed range or the temperature of 750 to 950 °C. Accordingly, Tseng is provided to show ranges of hydrogen to oxygen and other temperatures that may be used to achieve a better tantalum oxide gate dielectric for transistors, which also provides a suggest to combine the reference of Tseng with Luan--i.e. to obtain such better tantalum oxide films.

Conclusion

7. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event,

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however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Erik Kielin whose telephone number is 571-272-1693. The examiner can normally be reached on 9:00 - 19:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr. can be reached on 571-272-1702. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Erik Kielin
Primary Examiner
19 July 2004